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ANTI-PREDATOR BEHAVIOR IN SWARMS OF *RHAGOVELIA OBESA* (HEMIPTERA: VELIIDAE)

G. Scott Deshefy

Department of Zoology, Clemson University, Clemson, SC 29631

The broad-shouldered water strider or riffle bug, *Rhagovelia obesa* (Uhler, 1871), is an aquatic hemipteran commonly found along edges of lotic habitat. Its prey principally consists of small insects and crustaceans, trapped within the water's surface film. The median legs, equipped with fan-shaped, setal plumes at apical segments of the tarsi, provide locomotion, beating alternately beneath the water surface (Bueno, 1907; Coker et al., 1936; Cheng and Fernando, 1971). *Rhagovelia obesa* is active in low temperatures and undergoes four larval stages (Cheng and Fernando, 1971). First instar nymphs have been observed in late May in South Carolina. Adults have been observed in November.

Behavioral experiments were conducted on *Rhagovelia obesa* populations on 18-mile Creek in Pendleton, South Carolina. Both nymphs and adults were observed to aggregate into swarms, disperse when disturbed and eventually reassociate. Insects were observed in groups ranging from 4 to 80 individuals. Mating pairs were occasionally included in swarms and were observed as early as July.

Ten large swarms were investigated at midday along various points of 18-mile Creek. Experiments were conducted during sunny days over a two week period using sub-surface and overhead "approach models" to stimulate dispersal. Sub-surface models, resembling salmonid dorsal silhouettes, consisted of metal ovals, approximately 25 cm × 6 cm and painted flat black and dark green. Sub-surface models were pulled by monofilament line along the sandy creek bottoms and were slowly drawn upstream towards riffle bug swarms.

Overhead models were constructed from crow and blue jay skins, stretched across 15 cm × 8 cm × 5 cm wooden frames. These models were suspended from fishing line and lowered by bamboo pole directly above *Rhagovelia obesa* swarms. Twenty trials at five minute intervals were performed for each experiment and for each insect group. Riffle bug responses to shadow movements and water surface disturbances were also noted.

Both moderate and rapid introductions of overhead models resulted in immediate dispersals of tested swarms. The same reactions occurred when gentle, irregular wave action was generated by randomly splashing a wooden ladle within a few feet of the insects. Both experiments revealed that, fol-

lowing 8 to 10 trials, repeated disseminations led to reduced swarm cohesion and partial extinction of dispersal behavior. Aggregates also exhibited small increases in time elapsed prior to regrouping.

However, insect swarms, approached by slowly moving shadows cast on the streambed, maintained tight formations and avoided the projections with coordinated group movements. Riffle bug swarms also behaved as organized units while moving in advance of and at the same speed as approaching sub-surface models.

The described results suggest that swarms of *Rhagovelia obesa,* which may facilitate mate availability, could also function as an indirect deimatic anti-predator defense. Coordinated avoidance of sub-surface images appears to function as a primary defense mechanism. Supplementing this behavior, riffle bug swarms, dispersing at the instant of attack, may further create a secondary "flash" stimulus. Such rapidly scattering assemblies of insects could effectively distort or obliterate search images of approaching fish or fowl.

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